ElNet LTE   Energy Meter
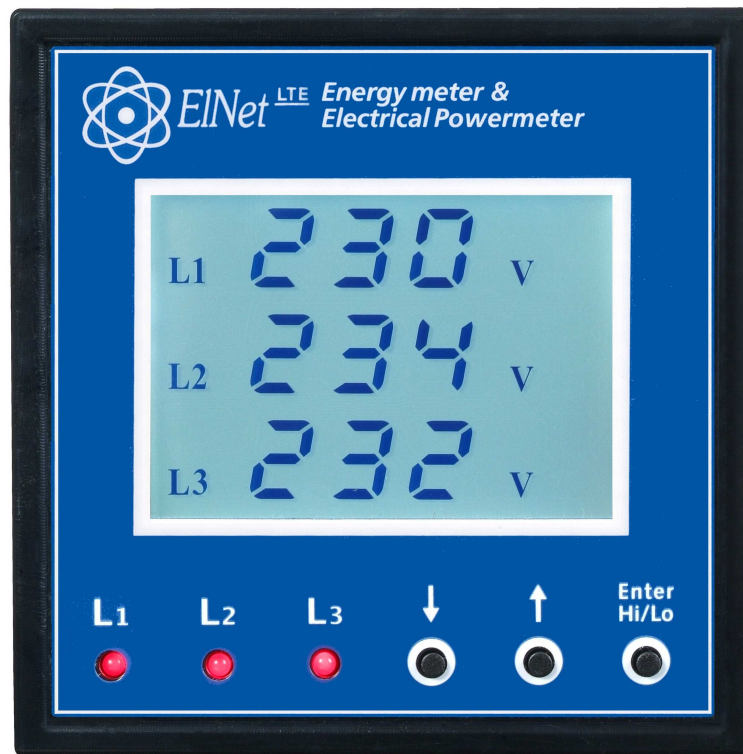# & Electrical Powermeter

Operating Instructions
Revision 1.4

CONTROL APPLICATIONS Ltd.

Supervision & control system
Tel: +972-3-6474998 Fax: +972-3-6474598 24a Habarzel St. Tel-Aviv, 69710, Israel

Table of Contents

1

Dear customer, thank you for selecting the Elnet LTE Multimeter for measurements of voltage, current, power, power factor and energy.
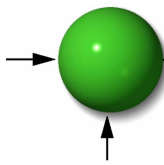
1. General specifications

1.1. Technical Data:

Power Requirements	: 110 or 230 VAC ± 10%
	: 90 - 250 VAC (optional)
	: 110 - 280 VDC (optional)
	: 60/50 Hz
	: 20VA
Dimensions (H x W x D)	: 96 x 96 x 80 mm
Shipping Weight	: 450 gr.
Working Conditions	: -20 – 70ºC
	: 0 - 95 RH%
Measurement Range:	
Voltage	: 0 - 650 VAC
Voltage (with transformer)	: up to 999 KV
Current (with transformer)	: up to 999 KA
Maximum Input Voltage	: 1000V
Maximum Input Current	: 6A

2

1.2. Measurement and Display Range:

Measurement Parameter	Display Range in direct connection (scaling factor 1)	Measuring in direct connection (scaling factor 1)	Display Range
Current	0.01 – 6A	0.01 – 6A	0.01 – 999KA
Neutral Current (calculated)	0.01 – 6A	0.01 – 6A	0.01 – 999KA
Voltage L-N	0.00 – 650 V	0.00 – 650 V	0.01 – 999KV
Voltage L-L	0.00 – 650 V	0.00 – 650 V	0.001 – 999KV
Frequency (Hz)	45.1-65.1 Hz	45.1-65.1 Hz	45.1-65.1 Hz
Active power total\phase			0.00W – 999KW
Reactive power total\phase			0.00VAR -999KVAR
Apparent power total\phase			0.00VA -999KVA
Power Factor (cap.\ind.)	-1.000 ÷ 1.000	-1.000 ÷ 1.000	-1.000 ÷ 1.000
Active Energy total\phase			0.001WH – 99999999KWH
Reactive Energy total\phase			0.001VARH - 99999999KVARH
Apparent Energy total\phase			0.001VAH - 99999999KVAH
Harmonic THD V\I			0.00 – 100%

Table 1.1 – **Measurement and Display Range**

3

2. Settings and measurements

2.1. Current transformer ratio setting:

1. Press the Enter button for about 6 seconds.
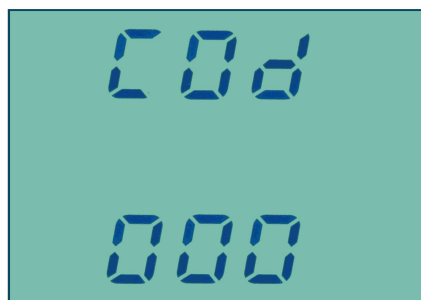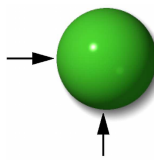2. The enter password screen will appear "COD".

Figure 2.1 – **Enter Code**

3. Use the "↑" button to change the number to "1" and then press Enter.
4. The message "SET" will appear on the screen, use the "↑ ↓" buttons to choose the current transformer ratio setting – "A" and press "Enter".

4

5. The current transformer setting screen will appear.

Figure 2.2 – **Set Current Transformer**

6. On the second line of the screen appears the secondary value of the current transformer (5A). On the third line appears the value of the primary current transformer which you can change by using the "↑ ↓" buttons, when finished press "Enter".

7. Use the "↑" button until the message "End" appears on the screen and then press "Enter".

2.2. Voltage transformer ratio setting:

1. Repeat steps 1.3.1 -1.3.3.
2. Use the "↑" button until "Set V" appears on the screen and press "Enter".
3. On the second line of the screen appears the secondary value of the voltage transformer (110V). On the third line appears the value of the primary voltage transformer which you can change by using the "↑ ↓" buttons, when finished press "Enter".

5
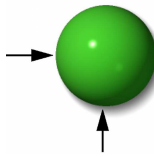
4.   Use the "↑" button until you see the message "End" on screen and then press "Enter".
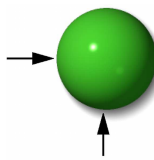
2.3. Measured values display:

1.   Use the "↑ ↓" buttons to browse among all the display screens including display of voltage, current, power, frequency, power factor, power measurement (Active, Reactive, and Apparent), Active and Reactive energy and the THD voltage and current.

Figure 2.3 – **Energy display**

2.4. Peak display:

1.   Pressing the Hi/Lo button will browse among the screens specifying the peak of voltage and current that were ever measured for each phase:
- High measured voltage current (Hi) – L1, L2, L3.
- Max demand current (Hi.d) – L1, L2, L3.
- Low measured voltage current (LO) – L1, L2, L3.
- High (Hi) measured Frequency (hz), Power Factor (Cosφ) – L1, L2, L3.
- Low (LO) measured Frequency (hz), Power Factor (Cosφ) – L1, L2, L3.

6

2.5. Indication LEDs:

1.   The indication LEDs easily enables the user to identify whether there is voltage in phases L1, L2, L3. In case there is voltage in phase connections, the LED will turn on (at least 50 VAC).
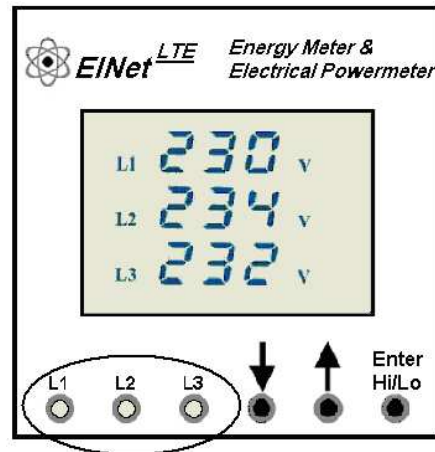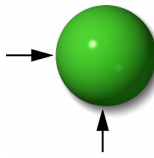

Figure 2.4 – **Indication Leds**

7

2.6. No volt & phase order alarm relay (option):

1.   When the voltage is proper (above 50VAC, adjustable) and the phase order is proper, the alarm relay will be closed, as it appears in the wiring diagram. The maximum current possible to transfer through this relay is 150ma, which is enough to operate a regular control relay.

2.   To set the minimum voltage value for the No Volt alarm, and to enable / disable the alarms relay in case of phase disorder please read **paragraph 5.0** General Setting.

8

3. **Installations**

   3.1. Mechanical installation:

   > **Comment:** Please do not install the ELNET LTE Powermeter close to electrical bars.
   > Please leave enough space to approach the device from its back side for technical support.

   - Please choose the proper place for installation in the panel and prepare a square hole according to Figure below:

   Height 90 mm

   Width 90 mm

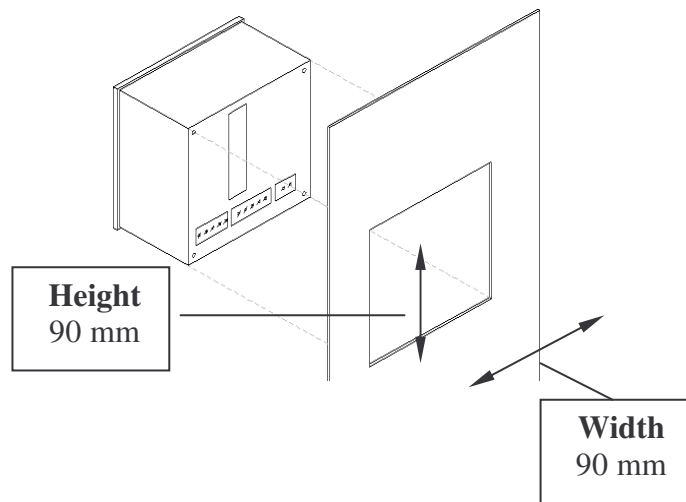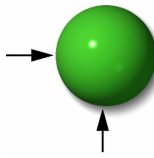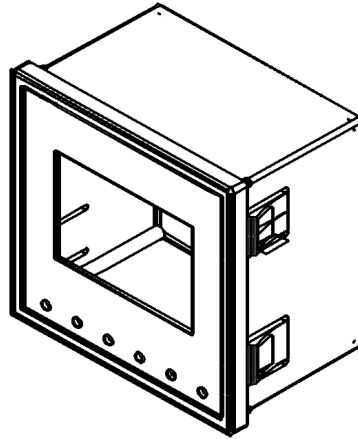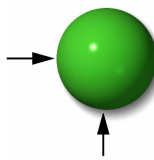   Figure 3.1 – **Space in the electrical panel**

9

- Please insert the ELNET LTE Powermeter into the suitable space prepared in advance. Make sure you insert the device in the right direction. The device is equipped with a plastic knob for adjustment when installed in electrical panels. The thickness of the panel door should be less than 4mm.
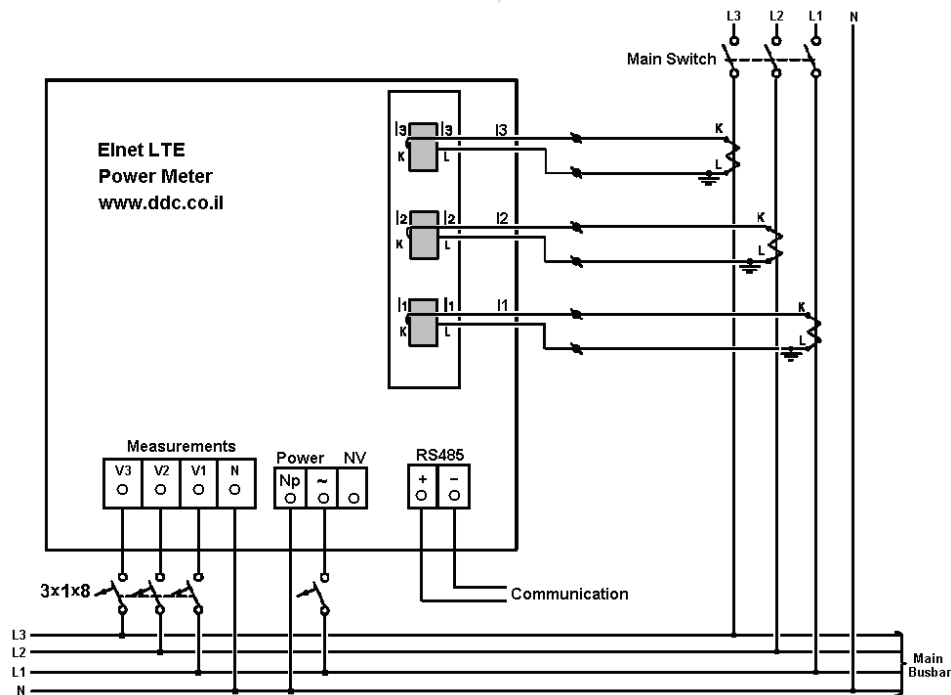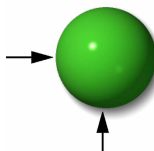

10

3.2. Wiring diagram:

Figure 3.2 – **Wiring Diagram**

11

4. MODBUS Protocol:

The *ElNet LTE* Energy & Power Multimeter has a serial interface port allowing direct interface with an external communication network supporting the MODBUS Protocol.

MODBUS is an Industry Standard, widely known and commonly used communications protocol. Using MODBUS provides communication between a PC and up to 247 Powermeter slaves on a common line - the PC being the **master** and the powermeters the **slaves.** The PC initiates the transaction (either a query or broadcast) and the Powermeter(s) responds. Powermeters respond to the **master** PC's request, but will not initiate any transmission on its own. The PC sends a single Query transaction and the Powermeter responds in a single response frame and is capable of only one query and one response at a time.

4.1. MODBUS Framing

MODBUS uses the standard Remote Terminal Unit (RTU) transmission mode. RTU mode sends data in 8-bit binary with or without parity bit data format. For the *ElNet LTE* Energy & Power Multimeter to successfully communicate, choose "1" in the communication Set Up.

Field	No. of bits
Start bit	1
Data bits	8
Parity	1
Stop it	1

RTU Data Format

12

4.2. RTU Frame Format:

Query and response information is sent in frames.
Each frame contains: Address; Function; Data;
Check.

Address	Function	Data	Check
8 bits	8 bits	N * 8 bits	16 bits

RTU Message Frame Format

If the receiving device (Powermeter) detects a time laps of
<u>five</u> characters, it will assume the message is incomplete
and will flush the frame. The device then assumes that the
next byte received will be an address. The maximum query
and response message length is 256 bytes incluiding check
characters.

4.3. Address Field:

Each Powermeter is designated in a network system by a
user assigned address. The Address can be any number
between 1 and 247. The Powermeter will only respond to
its own specifically assigned address.

4.4. Function Field:

The function field contains the code that tells the
Powermeter what action to perform.
The *ElNet LTE* uses and responds to four standard
Message Format Functions.
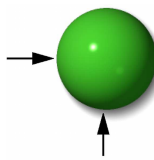
13
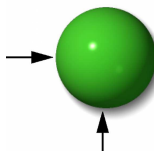
Function Codes : 03;04;06;16

Function	Meaning in MODBUS	Action
Function 03	Read holding register	Obtain data from Powermeter
Function 04	Read input register	Obtain data from Powermeter (Read register)
Function 06	Preset single register	Transmit data to Powermeter (Write single register)
Function 16	Preset multiple register	Transmit data to Powermeter (Write multiple register)

4.5. Data Field:

The Data field contains the body of the message and contains instructions from the PC master to the Powermeter slave to perform a particular action or respond to a query. The reply message from the Powermeter will be information contained in one or more of its registers.

4.6. Check Field:

The error check field contains the result of the Cyclical Redundancy Check (CRC). The beginning of the message is ignored when calculating the CRC.
For more detailed information on CRC, refer to the MODBUS Protocol Reference Guide.
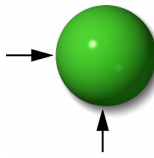
14

4.7. Registers for Elnet LTE Powermeter:

The *ElNet LTE* is capable of supporting either the Function 03 or Function 04 Message Format. In a reply to a query from the PC **master** for a reading from a particular field, the response from the Powermeter can be either in Format 03 or Format 04 but will depend on the Format the query was originally sent in.

The difference is significant because when using Function 03, the ElNet LTE will only send the **INTERGER** part of the field value requested and the PC **master** will only display the INTERGER part of the field value. On the other hand, Function 04 is capable of sending two separate halves of the full **FLOAT** requested information (each half contained in a separate register). Then it is the task of the PC **master** to merge the two halves into a full **FLOAT** reply (For more detailed information See IEEE Standard 754 Floating - Point).

E.G. 1: If the user's PC **master** supports Function 03, then the reply will contain the INTERGER part of the field only.
The PC **master** requests the Voltage rom Line1, and the actual Voltage in that field is 230.5 Volts. Function 03 will respond with the INTERGER only i.e.230V.

E.G. 2: If the user PC **master** supports Function 04, then the reply will contain the information stored in the two registers asssigned to that field and will contain the full and accurate reply.
The PC master requests the Voltage from Line1, and the actual Voltage in that field is 230.5 Volts.
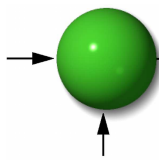
15

Function 04 will respond with a composite reply of both register 1 and 2 giving the full **FLOAT** value (in IEEE Format) from that field i.e. 230.5V.

4.8. Register addresses:

The *ElNet LTE* MODBUS registers addresses are updated from time to time and can be downloaded from the following web site:

http://www.ddc.co.il/elnet-pdf/elnet_comm.pdf

16

5. Communication Settings:

In order to connect the *ElNet LTE* Energy & Power Multimeter to a PC or other device, for successful communications, both Communication Setup parameters must match; i.e. the PC port and the configuration settings of the Power meter, Address, Baud Rate, Parity must match.

5.1. Communication Address:

Each Power meter in a communication system must have its own unique address. *ElNet LTE* works on MODBUS protocol, so the available addresses are - from '1' to '247'.

5.2. Baud Rate:

The Baud Rate is the communication speed in Bits per second (BPS) for communication between *ElNet LTE* with the PC or other device. The better the communication line quality, th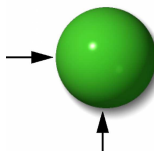e faster the communications may be (higher Baud Rate value). If the communication line is routed through a "noisy" environment, it may be necessary to decrease the Baud Rate.

5.3. Available Baud Rates for the ElNet LTE

are: 300; 600; 1200; 2400; 9600; 19200 bps.

5.4. Parity:

The parity can be defined as **ODD**, **NONE** or **EVEN**.

17

6. Communication & Alarms Settings

6.1. To set up Communication

1. Press the "Enter" button for about 6 seconds until the insert password screen will appear.
2. Use the "↑" to change the password (COD) to "2" and press "Enter".
3. The message "SET" will blink on the screen. On the second line, you will find the functions that require setting.
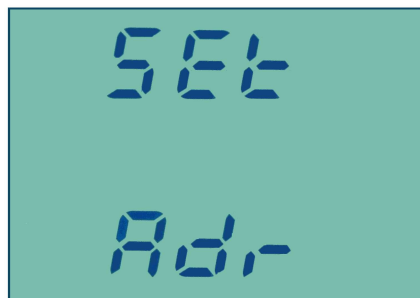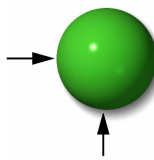

Figure 6.1 – **Communications settings**

4. Use the "↑ ↓" buttons to chose the required communication feature and press "Enter":
   - Address **"Adr"** – can be changed by using "↑ ↓" buttons from 1 to 255, when finished press "Enter".
   - Baud "**bud**" – use the "↑ ↓" buttons to choose 300,600,1200,2400,4800,9600,19200.
   - Parity **"PAr"** - use the "↑ ↓" buttons to choose from:
     O81 - ODD, 8 data bit, 1 Stop bit.
     E81 - EVEN, 8 data bit, 1 Stop bit.
     n81 - NONE, 8 data bit, 1 Stop bit.

18

6.2. To set up Alarms:

1. Press the "Enter" button for about 6 seconds until the insert password screen will appear.
2. Use the "↑" to change the password (COD) to "2" and press "Enter".
3. The message "SET" will blink on the screen.

* The following will activate the "Alarms relay":

4. In order to set the Low Voltage alarm - use the "↑ ↓" buttons to scroll to **"AL"** and press "Enter".
5. The SET ALARM screen will appear - use the "↑ ↓" buttons to define the Low Voltage level for activating the alarm and press "Enter".
6. In order to set the Phase Order alarm - use the "↑ ↓" buttons to scroll to Ord and press "Enter".
7. The Phase Order alarm will appear, use the "↑ ↓" buttons in order to activate\deactivate the alarm (change from No to Yes).
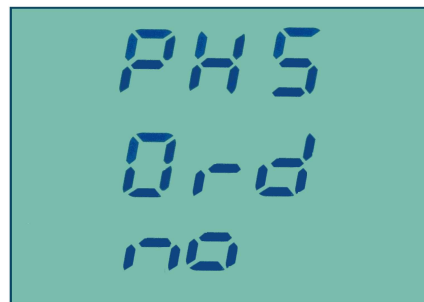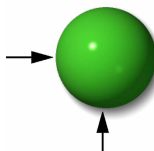

Figure 6.1 – **Communications settings**

19

Functions List:

Function	Value	Comments
Adr	0-247	Powermeter address
Bud	300-19200 BPS	Setting the Baud rate
COP	O = ODD N = NONE E = EVEN	Parity setting Data field is fixed = 8 bit Start/Stop bit is fixed = 1 bit
AL	0- 400 V	Minimum voltage to activate the "No volt relay".
Ord	YES = Yes NO = NO	Setting the option to activate the "No volt relay" by the phase disorder problem.

8. When finished use the "↑ ↓" buttons until the "End" the message will appear and presses "Enter".

20